Name: ______________________ Date: ______________

Polynomial Operations SOLUTIONS (version 36)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -3x^5 - 8x^3 - x^2 - 2x + 9$$

$$q(x) = -5x^5 + 8x^4 + 6x^2 + 2x - 3$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$p(x) = (-3)x^5 + (0)x^4 + (-8)x^3 + (-1)x^2 + (-2)x^1 + (9)x^0$$
$$q(x) = (-5)x^5 + (8)x^4 + (0)x^3 + (6)x^2 + (2)x^1 + (-3)x^0$$
$$q(x) - p(x) = (-2)x^5 + (8)x^4 + (8)x^3 + (7)x^2 + (4)x^1 + (-12)x^0$$
$$q(x) - p(x) = -2x^5 + 8x^4 + 8x^3 + 7x^2 + 4x - 12$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -3x^2 - 6x - 5$$

$$b(x) = 4x + 5$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-3x^2$	$-6x$	-5
$4x$	$-12x^3$	$-24x^2$	$-20x$
5	$-15x^2$	$-30x$	-25

$$a(x) \cdot b(x) = -12x^3 - 24x^2 - 15x^2 - 20x - 30x - 25$$

Combine like terms.

$$a(x) \cdot b(x) = -12x^3 - 39x^2 - 50x - 25$$

3. Express $(x+1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTIONS (version 36)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 3x^3 - 25x^2 - 18x + 10 \\ g(x) &= x - 9 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-9}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & 3 & -25 & -18 & 10 \\ 9 & & 27 & 18 & 0 \\ \hline & 3 & 2 & 0 & 10 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 3x^2 + 2x + \frac{10}{x-9}$$

In other words, $h(x) = 3x^2 + 2x$ and the remainder is $R = 10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 3x^3 - 25x^2 - 18x + 10$. Evaluate $f(9)$.

You could do this the hard way.

$$\begin{aligned} f(9) &= (3)\cdot(9)^3 \ + \ (-25)\cdot(9)^2 \ + \ (-18)\cdot(9) \ + \ (10) \\ &= (3)\cdot(729) \ + \ (-25)\cdot(81) \ + \ (-18)\cdot(9) \ + \ (10) \\ &= (2187) \ + \ (-2025) \ + \ (-162) \ + \ (10) \\ &= 10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(9)$ equals the remainder when $f(x)$ is divided by $x - 9$. Thus, $f(9) = 10$.